CMSC 451: Design and Analysis of Algorithms

Spring 2017

http://www.cs.umd.edu/class/spring2017/cmsc451/

Course Overview: This course presents the fundamental techniques for designing efficient computer algorithms, proving correctness and analyzing complexity. General topics include graph algorithms, basic algorithm design paradigms (e.g., divide-and-conquer, dynamic programming and greedy algorithms), lower bounds and NP-completeness.

Instructors: Jessica Chang (`jschang@cs.umd.edu`) and Samir Khuller (`samir@cs.umd.edu`)

Teaching Assistants:

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Andrew Liu (`aliu1@umd.edu`)

Class Time: Tuesdays and Thursdays, 5-6:15pm, CSIC 3117

Office hours: When sending email, you must put "CMSC 451" in the subject line or else it may not get read. All office hours are in AVW4101 unless otherwise indicated.

Jessica (AVW4153)/Samir (AVW4175): TuTh, 4-5pm; or by appointment.
Saba: MW 10:30-11:30; Tu 12-1
Karthik: M 4-5; TuTh 1-2
Khoa: W 1:30-4:30
Andrew: M 1-2; W 3-5

Texts:

Required: *Algorithm Design* by J. Kleinberg and E. Tardos. ISBN 0-321-29535-8, published by Addison Wesley (2005).

Recommended: *Introduction to Algorithms* (by T. Cormen, C. Leiserson, R. Rivest and C. Stein, publisher MIT Press, 2009)

Prerequisites: CMSC 351. Each student is expected to know basic concepts of programming (e.g., loops, pointers, recursion), discrete mathematics (e.g., proof by induction, sets), simple data structures (e.g., lists, stacks, queues, trees, heaps) and calculus (e.g., logarithms, differentiation, integration). We will assume knowledge of basic algorithm analysis techniques (material typically covered in CMSC 351).

Piazza: We will use Piazza for online class discussion. This is the best way to get help fast and efficiently from classmates, the TAs and us. Rather than emailing questions to the teaching staff, we strongly encourage you to post questions to Piazza. Find the 451 Piazza page at `https://piazza.com/umd/spring2017/cmsc451`.

Course Work: Course work will consist of 8-9 homework assignments, and three exams (two in-class exams and a comprehensive final).

Homework sets will be mathematically oriented. For each set, we may choose a random subset of problems to grade. Since homework solutions will be handed out on the day the

homework is due, **NO LATE HOMEWORKS WILL BE ACCEPTED.** In other words, submit whatever you have finished. Instructions for how to submit homeworks will be given with the posting of Homework 1. If you cannot come to class on the due date, it is your responsibility to make sure that we have your homework **before** the start of class.

All homeworks are to be done independently, unless otherwise specified. Posting homework solutions in public online locations is considered a violation of the academic integrity policy. Needless to say, you are expected to maintain the utmost level of academic integrity in this course. If you have questions, please talk to one of the TAs or to us.

Assignments are to be written up neatly and concisely. Poorly written assignments will not be graded. Staple your homework. **It is your responsibility to obtain all homeworks and handouts. All course information and handouts will be available on the web page.**

Exams: There will be two in-class exams and a final exam. The in-class exams are tentatively scheduled for Tuesday, March 7, 2017 and Thursday, April 20, 2017. The final exam is scheduled for Thursday, May 18, 2017 from 4-6pm. If you miss an exam due to an illness, please contact us before the exam and upon return, providing written documentation from the Health Center or a health care provider, complete with contact name and phone number. This documentation must verify dates of the treatment and indicate the timeframe that you were unable to meet academic responsibilities. No diagnostic information will ever be requested.

Grading: Final grades will be determined by performance on homework sets, in-class exams, and the comprehensive final exam. The following weights are subject to change and will be roughly 25% from the homeworks, 40% from the two in-class exams and 35% for the final exam. We will adhere to the grading system that allows for + and − grades. At the end of the semester, course evaluations can be completed at `www.courseevalum.umd.edu`. These are important, and the department and faculty take student feedback seriously.

Syllabus: The general topics to be covered:

1. General algorithms background and examples of algorithms and problems.
2. Graph exploration: connected components, topological sorting, strongly connected components.
3. Greedy algorithms: minimal spanning trees, shortest paths, scheduling.
4. Divide-and-conquer algorithms: geometric algorithms, selection, lower bounds for minimum and sorting, Strassen's matrix multiplication.
5. Dynamic programming: shortest paths, Warshall's algorithm, optimal search trees.
6. Network flows and applications.
7. NP-completeness: introduction to reductions, the classes P and NP, NP-complete problems, approximation algorithms.
8. Randomized algorithms.

Fine Print: Any student eligible for and requesting academic accommodation due to a disability should provide us with a letter of accommodation from the Office of Disability Support Services (DSS) within the first two weeks of the semester.

In accordance with University policy, in the event that participation in religious observances conflicts with the course schedule, opportunities to make up missed assignments and exams can be discussed. However, again it is your responsibility to inform us of any intended absences for religious observances within the first two weeks of the semester.